indeed, made in the description of *F. pardus suahelica*, as this large-spotted race should be called, of the occurrence of spots within the rosettes, which form such a marked feature in the skin sent by Mr. Tomkins. This I take to be a jaguar-like feature, although, except as regards their relative large size and completeness, the rosettes are not specially jaguar-like. Mr. Pocock (*op. cit.*) has already directed attention to jaguar-like Asiatic Leopards; and if I am right in my interpretation of the markings of the present specimen, we have now evidence of a resemblance to the American species in an African Leopard.

In addition to the above, a Leopard from Mount Ruwenzori has been recently described by Prof. L. Camerano * as *Felis pardus ruwenzorii*. This also seems to be a large-spotted form; and it is difficult to see how it can be separated from *F. p. suahelica*, at all events till we have a fuller description of the type specimen of the latter. The ground-colour, judging from the description, appears, however, to be darker than in the specimen now exhibited.

I certainly cannot affirm that the skin sent home by Mr. Tomkins is not referable to *F. p. suahelica*. If, however, the Leopard from German East Africa shown in plate 180 of Dr. Heck's above-cited work be the type of *suahelica*, then the specimen before us may possibly be distinct.

The locality where the Leopard-skin was obtained is Gomba. The specimen, I am pleased to be able to add, has been presented by Mr. Stanley Tomkins to the British Museum.

4. On the Feeding of Reptiles in Captivity. With Observations on the Fear of Snakes by other Vertebrates.

By P. Chalmers Mitchell, D.Sc., LL.D., F.R.S., Secretary of the Society, and R. I. Pocock, F.L.S., Superintendent of the Gardens.

[Received November 12, 1907.]

For a number of years it has been the practice in the Society's Gardens to feed snakes in captivity on dead animals wherever possible. The feeding has taken place weekly on Fridays after the Reptile House has been closed to visitors, and has been part of the duty of our extremely competent keeper of the reptiles, J. Tyrrell, who has great experience and an unusual facility in handling reptiles and interpreting their wants. One or other of us has from time to time been present at the feeding, but we desired to make observations over a continuous period, and accordingly one or both of us have been present on all occasions when the snakes have been fed between the beginning of May

* Boll. Mus. Zool. Torino, xxi. 1906, No. 543, p. 1.

and the end of October 1907. We chose the summer months, as even in a House artificially heated all snakes feed less readily and some of them not at all during the winter months.

General Observations.

All our remarks under this heading relate to animals which have been killed before being offered to the snakes. Movements of the prey are movements that we have caused by various means, by throwing the animals in suddenly, by wriggling them with wooden forceps or attached twine, and so forth. We have not noticed any difference in the readiness of the snakes to take food if the animals were freshly killed, warm, or bleeding, or if they had been dead for some time; and it is to be noticed that in many cases the prey was not actually taken until night, long after it had been introduced; this was particularly the case when Pythons took large animals such as goats.

For the present purpose snakes may be divided into four groups:—Pythons; Non-poisonous Colubrines; Poisonous Colubrines; Vipers.

Pythons.—Pythons and Anacondas generally show their readiness to feed by special restlessness and activity; they move about restlessly, Pythons often leaving their tanks completely and Anacondas stretching part of the body out of the water; they become specially alert when they hear movements in the passage behind their cages, or when the back-doors are moved; in the words of the keeper, "they are asking for food." But this is not invariable; sometimes a Python will take no notice when the prey is thrown in or when it is moved in front of it or dangled over it, and yet later on it will take it. If the snake is eager, it makes a sudden dart at the prey, striking at no special part of the body and seizing and retaining hold with a violent bite. An Anaconda taking hold of a duck in this way almost at the same moment surrounds it with one or two tight coils and takes it under water. A Python without letting go throws a coil over it, holding it down; if the prey is of small size and motionless there is no attempt to wind the body round it, but if it is bulky or moves more coils are pressed over or round it. There appears, however, to be no special attempt to crush the prey, to suffocate it, or to break its bones. The amount of pressure or constriction exerted is, so to speak, a reflex action directly proportioned to the struggles or size of the prey. After some time, during which an originally living prey would have been suffocated, or in the case of the Anaconda drowned, the snake usually lets go its hold. It then passes its head all round the prey, playing over it with its forked tongue, and by some means other than that of sight, as the choice is made equally in the dark, perhaps by the sense of touch in the muzzle or lips, selects the head of the carcase to begin the process of swallowing. A snake that comes across a dead body behaves in the same way. We have never seen a snake

of the Python group make a mistake in its selection of the head and snout to begin on, and it is plain that the lie of hairs, or feathers, the position of horns and the general shape of the body of vertebrates, justify the snake in its choice. Occasionally in the process of swallowing, a coil of the snake appears to push against the posterior end of the prey, but this appears to be simply a means of holding the prey steadily. The mechanical process is one in which the snake pushes itself outside the carcase; it gives a huge gulp and fixes its teeth as far back over the body as is possible, and then slowly, in big wrinkles, pushes a portion of its mouth and gullet forwards; then with another gulp gets its teeth fixed still a little further on to the prey and repeats the forward bringing up of the body, the general appearance of the motion being similar to that of the progression of an earthworm. Frequently, when the prey is large, the process of ingestion is not straightforwards, the jaws being moved first to one side and then to the other, alternately. Whilst swallowing is taking place there is a certain amount of salivation, but the discharge is not so copious as in poisonous snakes, and no saliva is shed on the prey before the swallowing begins. A carcase wetted all over is one that has been swallowed and afterwards disgorged.

So far as the quantity of food taken by Pythons in the course of the year is concerned, our experience differs considerably from that of Mr. H. N. Ridley, who, writing of the specimens in the Botanical Gardens, Singapore *, says:—"Small-sized Pythons usually feed once a month. The large ones over 20 feet long usually once in from six to nine months. One which was about 22 feet long, not long after it was brought in, passed the remains of a deer. It fed again some time later on three chickens, and remained without food for six months, when it passed the remains of the fowls and then ate a good-sized pariah dog, which lasted it for nine months."

Non-poisonous Colubrine Snakes.—Such snakes, e.g. *Boodon lineatus*, *Spilotes corais*, behave very much like pythons in feeding. They seize the prey with a straightforward dart of the head and then, if it is of large size or moving, either lie upon it or partially twist round it to hold it steady. They then select the anterior end and begin to swallow it. If, however, the prey is of small size and easily swallowed, they take it straight away in the fashion of Cobras and Viperine snakes.

Poisonous Colubrine Snakes.—Our snakes in this category (Cobras) very seldom strike at dead food that is thrown to them. When the door of the cage is opened, they fix their attention on the keeper, and, if lively, stand up with the hood raised, watching him. They take dead food readily, swallowing it in the fashion of Viperine snakes, never being seen to lie partially over it or to coil round it as is done by non-poisonous Colubrines occasionally, and Pythons habitually.

* Journ. Straits Branch R. A. Soc. no. 46, p. 189 (1906).

Poisonous Viperine Snakes.—Puff-adders, Copperheads, and species of *Lachesis* very often strike dead food when it is thrown to them, or when it is dangled in front of them or otherwise made to simulate life. They strike and let go their hold in a moment, the strike and disengagement being equally rapid. If the prey is very small they occasionally swallow it at once. When swallowing dead food that they have struck and released, or, as frequently happened, that they had never attempted to strike, they are not infrequently indifferent to the direction of the hair, but begin to swallow from the anterior or posterior end of the prey with equal readiness. Salivation appeared to us to be much more copious than in the case of the Pythons.

It is possible that the rapid disengagement of the fangs after striking may be a protective instinct by which the snake avoids being bitten or clawed by its prey before the poison has taken effect.

Detailed Record.

In all these cases the prey was killed before being offered to the reptile.

Reticulated Python (*Python reticulatus*).

(East Indies.) *

a. A large specimen, judged to be 24 feet in length, deposited in Aug. 1898. This Python was thin and lethargic in the early part of the summer and could not be induced to feed until August. But having once made a start, he continued to feed till November while the warm weather lasted, and took in all six goats and six ducks. He never showed keenness, however; and was never seen to seize his prey with the swift head-drive characteristic of specimens *c* and *d*, even when it was made to move. He always approached it slowly and took it in a leisurely and deliberate manner, after searching for the head in the way described above. Quite commonly he refused to touch it before nightfall.

b. Of two large specimens deposited in April 1907, one did not feed before being returned to the depositor in September. The other refused all food through June and July but began to feed in August. He rapidly picked up in condition and on October 25th took one duck, one rabbit, one guinea-pig, and two pigeons; and on November 1st swallowed a small goat.

c. Presented in Oct. 1898. Always lively and vicious, this snake fed with great regularity all through June, July, and August, only refusing food on one or two occasions when sick for shedding. Rabbits were usually given; but he took a kid one day, although not with eagerness.

* Brackets indicate that the exact locality of the particular specimen is unknown.

d. Presented in Sept. 1890. Although not so active and eager as the last, this Python usually took one rabbit a week, from June to September. A kid offered to him on one occasion was rejected; but a rabbit was instantly seized.

e. This specimen, presented in 1894 and kept in the same cage as the last, was in poor condition at the beginning of the summer and was a bad feeder all the season, only now and again taking rabbits after they had been left some little time in the cage. The second time of feeding, he swallowed two rabbits within a few minutes of each other. For five days he lay as if dead, and then disgorged them, the swelling caused by the two rabbits showing no signs of lessening during that period.

Diamond Python (*Python spilotes*).

(Australia.)

Although no experiments were made upon a representative of this species, it is worth recording that an example deposited for a short time in the Gardens early in the year had been trained, we were told, to take dead rats from its owner's hand.

Common Boa (*Boa constrictor*).

(S. America.)

A specimen about six feet long, deposited during the month of August, took rats with avidity, swallowing five one after the other at the first trial. This snake had previously been fed upon living rats, as was ascertained from its owner, who, influenced by the popular belief, had never considered it worth while to offer it dead animals.

Anaconda (*Eunectes murinus*).

Para.

Presented in Aug. 1902. This snake began to feed at the end of June and continued to take ducks at irregular intervals until the end of August, being very uncertain in his appetite. He always fed in the water. Sometimes he required a good deal of persuasion in the way of moving the duck at the surface. At other times he would seize it from the keeper's hand the moment it appeared over the edge of the tank.

Cooke's Tree-Boa (*Corallus cookii*).

(Tropical America.)

Some newly imported specimens, deposited in the Gardens in the summer in very poor condition, would not take the food, and died after a few weeks without showing any signs at any time of recovering health.

Common Grass Snake (*Tropidonotus natrix*).

(England.)

The three specimens of this species in the Society's collection fed at irregular intervals upon young gudgeon and dace. They appeared to find the fish by scent.

Viperine Snake (*Tropidonotus viperinus*).

(North Africa.)

Like the specimens of *T. natrix*, one example of *T. viperinus* fed upon small fish.

Mocassin Snake (*Tropidonotus fasciatus*).

(North America.)

One specimen. Fed readily upon gudgeon, taking them without hesitation from the keeper's hand.

Corais Snake (*Spilotes corais*).

(S. America.)

Of two specimens of a black variety identified as variety *couperi* and presented in Oct. 1906, one or the other fed upon young rats nearly every week, the number taken at a meal varying from one to four. Another specimen, perhaps belonging to the variety *melanura*, which was deposited in September of this year, also took rats and sparrows as well; the keeper tells us that a specimen formerly exhibited in the house would eat pieces of raw meat off a plate. Sometimes these snakes made use of a loop of the body to hold their food to the ground; but usually they swallowed it without that aid after the manner of Viperine Snakes. They were never seen to coil round it.

Lineated Boodon (*Boodon lineatus*).

(S. Africa.)

A specimen of this species fed, but by no means regularly every week, upon small rats and mice. Upon one occasion he was seen to coil once round the carcase like a Python.

Corn Snake (*Coluber guttatus*).

(N. America.)

Annulated Snake (*Leptodira annulata*).

(S. America.)

Æsculapian Snake (*Coluber longissimus*).

(Europe.)

Rufescent Snake (*Leptodira hotambœia*).

(S. Africa.)

The specimens of these four species took fish. The Æsculapian Snake would also eat mice; but the Annulated Snake on one occasion took a gudgeon after refusing a dead mouse.

Indian Cobra (*Naia tripudians*).

(India.)

Although suffering from a tumour behind the head, from which it died in September, this snake took a rat on one occasion.

Yellow Cobra (*Naia flava*).

(S. Africa.)

This snake took one or two young rats nearly regularly every week.

Black-and-White Cobra (*Naia melanoleuca*).

(W. Africa.)

Like the Yellow Cobra, this snake, deposited in Aug. 1905, fed nearly every week, except when quiescent before shedding his skin. He took from one to four rats at a meal.

Puff Adder (*Bitis arietans*).

(S. Africa.)

Of this species the Society possesses a very large number of specimens, mostly presented during the course of the present year by Mr. A. W. Guthrie, C.M.Z.S., of Port Elizabeth. Owing to the necessity of keeping a number together in one cage, it is quite impossible for us to state that all of them took dead rats. Some five or six rats, however, were placed in each cage every week, and were for the most part eaten, sometimes at once, sometimes in the course of the night. A large specimen, deposited in May 1906, and kept in a cage by himself, took small rabbits, guinea-pigs or rats fairly regularly throughout the summer.

Copper Head (*Ancistrodon contortrix*).

(N. America).

Three specimens of this species, received in 1900 and 1901, have fed regularly on rats throughout the summer and autumn.

An example of an allied species, the Water-Viper (*Ancistrodon piscivorus*), that was formerly exhibited in the Zoological Gardens at Clifton, was fed upon pieces of raw meat, which it took just as readily as the Society's specimens take rats or mice.

Fer-de-Lance (*Lachesis lanceolata*).

(S. America.)

The three snakes of this species possessed by the Society are the survivors of a brood of about twenty purchased in Dec. 1905. They were fed at first upon small fish. They now take mice and small rats, and are the best feeding snakes in the collection. They have scarcely refused food once through the summer and autumn, and raise their heads in expectation as soon as they hear the doors of the adjoining cages being opened.

Some additional specimens deposited in September of this year refused all food for the first five weeks. A large one, however, took a half-grown rabbit at the beginning of November.

Crossed Viper (*Lachesis alternata*).

(S. America.)

Three specimens, deposited in August 1905, have fed almost as regularly through the season as the specimens of Fer-de-Lance. When frightened by the opening of the door of the cage, they sometimes make a rustling sound, quite audible through the glass, by rapidly vibrating the end of the tail against the sides of the cage. In their natural haunts no doubt the same sound would be produced by the shaking of the tail in the herbage.

We also found that Glass Snakes (*Ophisaurus apus*), one of the Lacertilia, *Hatteria* and some of the larger Frogs, such as the Bull-Frog, readily took dead mice and small rats. The frogs invariably hopped into the water with their prey immediately after seizing it, as if with the object of drowning a living animal as quickly as possible.

Summary of Record.

It will be noticed that throughout the many months over which our observations extended, our snakes fed with great regularity and at much shorter intervals than is generally reported, especially in the case of the Pythons. It is also noteworthy that we found no species of snake, poisonous or non-poisonous, that would not take dead food, and that it was unnecessary to give live food to any individual snake. In these respects, however, other observers of at least equal experimental enthusiasm, have had a smaller measure of success in inducing serpents to take dead prey. Private persons who have kept snakes and Directors of Zoological Gardens in Europe and America have spoken to us of getting only one snake in four to take dead food, of poisonous snakes that will never take dead food, and so forth. We set it down, therefore, not as a matter of scientific fact that all snakes can be persuaded to this non-natural form of diet, but as one of some interest that with the large collection in the Society's Gardens, we have been and hope to continue to be more uniformly successful in this mode of feeding reptiles than have been the owners of any other public or private collections with the exact details of which we are acquainted.

Emotional Attitude of other Animals to Snakes.

In the course of our own observations and experiments at the Society's Gardens and elsewhere, we have satisfied ourselves as to

certain facts regarding the psychical effect of snakes on other animals, facts partly known to those who have had an opportunity of observing them, but not yet matters of common knowledge. In the first place, there is no such thing as a power of fascination possessed by snakes. In the vast majority of cases there is not even a pretext for imagining the existence of such a power. A good many animals, however, are inquisitive, and this in the case of many small and feeble creatures, such as the smaller birds and mammals, is associated with the power of attention. If a movement is sudden or noisy, they may start off at once; if it is slow, silent, and stealthy, they remain motionless but intensely watchful. If a snake is quick enough, it may secure its prey in that brief moment of motionless watchfulness, but a human hand slowly and carefully advanced has just as much power of fascination.

The second point on which we have been able to satisfy ourselves is that, except in the case of one group, animals have no specific fear of serpents. The vast majority of animals, including of course frogs, rats and mice, guinea-pigs, rabbits, ruminants, and birds, are totally indifferent to their presence, and even when a snake approaches them directly avoid it, just as they would avoid a stick thrust at them. In the case of such animals, the problem involved in giving them alive to snakes is no more than whether they are killed more painlessly by snakes or by human beings. In their recognition and fear of snakes, however, the Primates are in marked contrast to all other animals. Many naturalists have recorded that monkeys display an instinctive fear of snakes, and we have made a number of experiments on this point, displaying live and active snakes, such as the brightly coloured Corn Snake, a Tree-Boa, and a small Reticulated Python, to the Monkeys in the Society's Collection. We assumed that it was unnecessary to select poisonous snakes, as probably monkeys, like most savages and many civilised persons, would make no distinction between poisonous and harmless snakes. We wish first to record the extremely interesting fact that Lemurs differ markedly from true Primates, inasmuch as they exhibit no fear of snakes whatever. It was most curious to notice how, when we approached adjoining cages, the one with lemurs the other with monkeys, carrying with us writhing snakes, how the monkeys at once fled back shrieking, whilst the lemurs crowded to the front of the cage, displaying the greatest interest and not the smallest perturbation when a snake was brought so close to them that its tongue almost touched their faces. We got the impression that had the lemurs been given the opportunity, they would at once have seized and tried to devour the snake. The South American monkeys showed fear in irregular and sometimes slightly marked form. Spider-monkeys (*Ateles*) were quite as excited and alarmed as any Old World monkey. Some of the larger Cebidæ did not retreat, but uncovered their canines and looked as if they were ready to show fight. Some small specimens retreated but showed no special

alarm, others were nearly indifferent. The Old World monkeys of all the genera in the Society's Collection recognised the snakes instantly and bolted panic-stricken, chattering loudly and retreating to their boxes or as high up as possible in the larger cages. Our large Baboons, including the huge Mandrill, were even more panic-stricken, jumping back in the greatest excitement, climbing as far out of reach as possible and barking. Of the Anthropoids, the Gibbons were least timid; one small agile Gibbon (*Hapale agilis*) showed no fear and very little curiosity; a larger one of the same species and a Hoolock receded but without showing panic. It is possible that the very markedly arboreal habits of the Gibbons have brought them so much less in contact with snakes that their fear of snakes is partly obliterated. The Chimpanzees, except one baby which was indifferent, recognised the snakes at once and fled backwards, uttering a low note sounding like "huh, huh." They soon got more excited and began to scream, getting high up on the branches or on the wire-work of their cages, but all keeping their eyes fixed on the snakes. Apparently they took a certain amount of courage from one another's presence, and they began slowly to draw nearer chattering loudly, but soon fled again screaming. The panic, however, at the presence of snakes was most sudden and best marked in the case of Orangs. The Society has at present two examples—a young female which came two years ago as a very small baby, and a large, probably adult male. Both of these are usually extremely slow and deliberate in their movement, but as soon as they got sight of a snake and long before it was near them, they fled silently but with the utmost rapidity, climbing as far out of reach as possible with a ludicrous celerity. It is well known that Anthropoid Apes are timid animals, readily alarmed at any strange creatures however small or harmless these may appear to be. One of our Chimpanzees was infested with large nematodes, and living examples of these that were passed with the fæces terrified the others. Earthworms similarly alarmed them, but nematodes and earthworms may have been mistaken by them for snakes. But mice, cockroaches, and guinea-pigs sometimes also terrify them extremely at first. We cannot doubt, however, that apart from this general timidity, monkeys (excluding lemurs) have a specific fear of snakes. It is probable that human beings have inherited this specific fear of snakes from their anthropoid ancestors, and that our inclination to attribute a similar fear of snakes to other animals is due not merely to erroneous observation but to an "anthropoidomorphic" prepossession.